ACCESSION #: 9402080199
LICENSEE EVENT REPORT (LER)

FACILITY NAME: McGuire Nuclear Station, Unit 2 PAGE: 1 OF 19

DOCKET NUMBER: 05000370

TITLE: A Unit 2 Reactor Trip Occurred Due To A Loss Of Offsite Power Caused By A Possible Unanticipated Environmental Interaction, Vendor Fabrication Deficiency, Deficient Documentation, Inadequate Surveillance Program, And An Inappropriate Action.
EVENT DATE: 12/27/93 LER #: 93-008-00 REPORT DATE: 01-26-94

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(i)
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: R. J. Deese, Manager, TELEPHONE: (704) 875-4065
McGuire Safety Review Group

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: HBC COMPONENT: VALVOP MANUFACTURER: C311
B HBC ICNTRL B040
E HBC VALVOP C311
X HBC ICNTRL W120

REPORTABLE NPRDS: YES
YES
YES
YES

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On December 27, 1993, Unit 2 experienced a loss of bus line 2B due to a failed insulator. This was followed by a failure of the Unit 2 Turbine Generator to runback. Bus line 2A subsequently tripped on an overcurrent condition. A Reactor Trip occurred at 2207 due to a Power Range High

Flux Rate Signal, followed by a Turbine Generator trip and the opening of the 2A Generator breaker. This resulted in a loss of Unit 2 offsite power. The subsequent cooldown resulted in a Safety Injection and Main Steam (SM) line isolation at 2214. Valve 2SM-5, SM Isolation Valve Steam Line B, failed to close fully, resulting in the 2B Steam Generator emptying. Control Room personnel declared an Unusual Event at 2222. As a conservative measure, OPS Control Room personnel activated the Technical Support Center, Operations Support Center, and staffed the Emergency Operations Facility. Offsite power was restored to Unit 2 at approximately 2343. Causes of Possible Unanticipated Environmental Interaction, Vendor Fabrication Deficiency, Deficient Documentation, Inadequate Surveillance Program, and Inappropriate Action are assigned to the event. Unit 2 was in Mode 1 (Power Operation) at 100 percent power, prior to the event. Corrective actions included repairs to the failed SM isolation valve and replacement of the failed bus line insulator. Unit 2 returned to Mode 2 (Startup) operation on January 6, 1994, at approximately 2200.

END OF ABSTRACT

EVALUATION:

Background

McGuire Nuclear Station, Unit 2, consists of the generating unit and auxiliary equipment. The unit generates power at a voltage of 24KV that is delivered through two half-size step-up transformers [EIIS:XMFR] to the McGuire 525KV switchyard [EIIS:FK] by overhead transmission lines. The output of the unit is then delivered into the Duke transmission system through switchyard power circuit breakers (PCB) [EIIS:52] in a breaker and a half configuration and transmission lines.

The following discussion describes the intended response of the turbine [EIIS:TRB] generator after a loss of one bus line:

In the event a fault occurs in one of the two independent circuits, the switching station PCB and the generator PCB in the affected circuit trip. The 6.9KV Normal Auxiliary Power System switchgear assemblies normally being fed from the affected circuit automatically transfer to the full-size auxiliary transformer supplied from the other independent circuit. The generator automatically runs back to half load, thereby maintaining non-interrupted ties between the transmission system and the 6.9KV Normal Auxiliary Power System, which is supplied from one auxiliary

transformer during this period.

Main steam (SM) [EIIS:SB] isolation valves (MSIV) (EIIS:ISV] are provided in each Steam Generator (S/G) [EIIS:SG] steam line immediately downstream of the code safety valves (EIIS:RV) to isolate each individual S/G in the event of a steam line rupture. The MSIVs close on high-high Containment pressure and/or on high Steam line pressure rate of change or low steam line pressure as the result of a SM line rupture between the S/G and the Turbine [EIIS:TRB] steam stop valves [EIIS:V].

Description of Event

On December 27, 1993, at 2206, Unit 2 Operations (OPS) Control Room (C/R) [EIIS:NA] personnel received an annunciator [EIIS:ANN] alarm [EIIS:ALM) for loss of bus line 2B. At the time the annunciator was received, Unit 2 was operating in Mode 1, at 100 percent power. The only significant equipment not in service at the time of the event was valve 2SV-7, "C" SM Power Operated Relief Valve (PORV), which was tagged out for implementation

of a Nuclear Station Modification (NSM). At the time 2B bus line was lost, OPS C/R personnel observed that the Turbine/Generator (T/G) [EIIS:TG] was not running back as designed.

While OPS C/R personnel were in the process of initiating a manual T/G load reduction, but prior to any actual manual load reduction, bus line 2A was also lost. A Reactor trip occurred due to a Power Range High Flux Rate signal. The Reactor trip was followed by a T/G trip and the opening of the 2A generator breaker. This resulted in a loss of Unit 2 offsite power. At this point OPS C/R personnel implemented the Unit 2 emergency procedures, beginning with procedure EP/2/A/5000/01, Reactor Trip or Safety Injection.

The loss of power to 4.16KV essential busses 2ETA and 2ETB caused the Train 2A and 2B Blackout logic to be initiated. Emergency Diesel Generators (D/G) [EIIS:EK] 2A and 2B were automatically started as designed and when the D/G 2A and 2B breakers closed, both Unit 2 4.16KV vital busses were re-energized. The Reactor Coolant (NC) [EIIS:AB] Pumps [EIIS:P], which are supplied from non-vital power, coasted down. Plant cooldown proceeded by natural circulation.

Both the Train 2A and 2B Motor [EIIS:MO] Driven (MD) Auxiliary Feedwater (CA) [EIIS:BA] pumps, along with the Turbine Driven (TD) CA pump, started and supplied water to the S/Gs.

NC system temperature and pressure quickly dropped below no load values following the Reactor trip. This was due to the introduction of CA system flow into the S/Gs and steam demand. Those steam demands include various steam line drain valves which are downstream of the MSIVs, that fail open on a loss of power, and valve 2SM-15, SM Supply to moisture Separator Reheaters Block, which failed as is on a loss of power. An NSM had been implemented to allow the steam line drains upstream of the MSIVs to fail closed upon a loss of power.

NC system temperature and pressure continued to decrease and by 2214, a Safety Injection (SI) on lOw Pressurizer (PZR) [EIIS:PZR] pressure occurred. The low PZR pressure SI signal was followed immediately by a low steam line pressure SI signal. With steam line pressure at the low pressure setpoint, a SM Isolation signal was also generated at 2214, to isolate the steam lines.

Following the SM isolation the NC system cooldown continued due to continuing CA system flow and decreasing steam pressure. OPS C/R personnel, while responding to the cooldown,

noted that valve 2SM-5, MSIV Steam Line B, was not fully closed. It was later determined that valve 2SM-7 MSIV Steam Line A, exhibited some leakage, although to a much smaller degree than valve 2SM-5. At approximately this same time personnel were dispatched to attempt to manually close valves 2SM-5, 2SM-15, along with valves 2SM-83, 89, 95, and 101 (A,B,C,D SM Line Drain). Instrument and Electrical (IAE) personnel subsequently placed air line jumpers on valves 2SM-83, 89, 95, and 101, in an attempt to close these valves. It was later determined that this action actually opened valves 2SM-83, 89, 95, and 101, rather than closed them. This action had no appreciable effect on the cooldown rate.

At 2222 the OPS Shift Supervisor declared a Notification Of Unusual Event (NOUE) in accordance with the McGuire Nuclear Station Emergency Plan. During the notification process the State/County notification form from procedure RP/0/A/5700/01, Notification Of Unusual Event, was also sent to the NRC. Procedure RP/0/A/5700/10, NRC Immediate Notification Requirements, was not completed at that time.

At 2223 CA system flow was stopped to all four S/Gs in accordance with the emergency procedures, and with valve 2SM-5 partially open, 2B S/G began to empty. OPS C/R personnel subsequently isolated CA system flow to 2B S/G. At 2224, valve 2SM-15 began to close. These actions caused

the NC system cooldown to begin to stabilize. At 2225, OPS C/R personnel had transitioned through the emergency procedures to procedure EP/2/A/5000/3.1, SI Termination Following Excessive Cooldown.

Between 2228 and 2249 the PZR PORVs cycled to control increasing PZR pressure which was due to the mass addition to the NC system resulting from the SI. Later in the event, OPS C/R personnel took manual control of a PZR PORV to reduce the differential pressure across the 2B S/G tubes tO 1600 psid in accordance with the emergency procedures. During the process of reducing NC system pressure, at approximately 2326, the PZR Relief Tank (PRT) [EIIS:TK] Rupture Disks relieved to prevent overpressurization of the PRT. The release of pressure from the PRT resulted in a Unit 2 lower compartment pressure increase, which caused the opening of a number of lower Ice Condenser [EIIS:NF] doors. This was indicated by increasing ice Condenser temperatures at 2330.

At 2342 bus line 2A was re-energized and offsite power was restored. On December 28, 1993, at approximately 0011, OPS C/R personnel made a decision to activate the McGuire Technical Support Center (TSC) and Operations Support Center (OSC); and to staff the Emergency Operations Facility (EOF), to provide assistance to OPS C/R personnel. This activation was not required for a Notification Of Unusual Event.

At 0018, 4.16KV essential bus 2ETB was re-energized from offsite power. Essential bus 2ETA was re-energized from offsite power at 0032. At 0137, NC pump 2A was started, restoring forced flow through the Unit 2 Reactor core.

At 0330, the TSC reached a decision to take Unit 2 to Mode 5, Cold Shutdown.

At 1201, sampling of 2B S/G was completed, confirming there was no primary to secondary leakage indicated. The TSC was deactivated on December 28, 1993, at 1245.

Conclusion

This event is assigned causes of Possible Unanticipated Environmental Interaction, Vendor Fabrication Deficiency, Deficient Documentation, Inadequate Surveillance Program, and Inappropriate Action.

A cause of Possible Design, Manufacturing/Quality Assurance Deficiency, Unanticipated Environmental Interaction is assigned to the failure of the 525KV switchyard underhung insulator [EIIS:INS].

Analysis of the failed insulator revealed that a fracture of the multi-cone insulator occurred through the uppermost cone of the insulator, flush with the top of the second cone. Swelling of the cement over the second cone may have provided the axial tensile stress which apparently initiated the failure. Cement growth is a time and moisture dependent process. It appeared that an old radial crack in the top cone may have allowed moisture into the pocket of cement over the second cone. However, other diffusion based methods of moisture influx are also possible.

As a result of this insulator failure the following corrective actions were initiated:

a) Underhung insulators on offsite bus lines 2A and 2B were replaced.

b) The damaged Y phase of bus line 2B disconnect was removed and replaced with cable jumpers.

c) The X and Z phase of the 2B disconnect switch were closed and the operators were disabled so the switches cannot be opened.

d) The Y phase of PCB disconnect switch 62R, which was damaged in the event, was repaired.

e) Two damaged insulators on PCB disconnect switch 62R were replaced.

f) A Nuclear Network bulletin discussing the insulator failure was issued on December 31, 1993.

It should be noted that bus line 2A could have been re-energized immediately following the opening of the Unit 2 generator breakers on December 27, 1993. However, the Senior Staff Engineer responsible for the secondary side of the plant decided that since the Unit 2 emergency D/Gs had successfully started and re-energized the Unit 2 4.16KV vital busses, a walkdown inspection of bus line 2A should be completed prior to returning the bus line to service. This walkdown was necessary to ensure the integrity of bus line 2A. The walkdown was completed, verifying no damage to bus line 2A. Bus line 2A was re-energized at 2342.

A cause of Vendor Fabrication Deficiency is assigned to the failure of the Unit 2 T/G to runback following the loss of the 2B offsite bus line.

This cause is assigned because jumpers on Digital Input Slave Module (DSI01) which configure the module for either 24VDC or 125VDC operation were mispositioned by the vendor during the setup of the new Digital Electro-Hydraulic (DEH) system.

Investigation into the failure of the T/G runback revealed burned resistors on Digital Input Slave Module (DSI01). One of the burned (failed) resistors prevented the runback signal from being recognized. The other failed resistor prevented the "Breaker Closed" input from responding.

The resistor failures were due to "Input Voltage Select" jumpers which were not properly Positioned for 125VDC operation, as required. Instead, the jumpers were configured for 24VDC operation. This caused an excessive current through a current limiting resistor in each of the input circuits. The excessive current resulted in overheating of the resistors, and after a period of time, the failure of the resistors.

A search of the equipment history for the new DEH system, which was installed in 1987, indicated the jumpers had not been examined or changed since their original installation by the vendor. It was also determined that previous testing of the circuits would not have detected the problem, prior to the complete failure of the resistors. It is known

that the Unit 2 T/G runback circuit was functional as recently as June 28, 1991, at approximately 0836. At that time an event occurred, which was documented in LER 370/9105, that initiated an automatic runback to 56 percent load.

As a result of the Unit 2 T/G runback failure, the following corrective actions were initiated:

a) The failed DSI01 module was replaced with a new module which was properly configured for 125VDC operation. The new module was tested to verify that all inputs through the module operated and responded properly

b) All other modules of this type on Unit 2 were verified to be properly configured for 125VDC operation.

c) All modules of this type on Unit 1 were visually verified to be properly configured for 125VDC operation.

d) Additional preventive maintenance checks (PMs) will be set up

to ensure field digital inputs to the DEH system are tested and verified to operate each refueling outage.

e) The DEH system vendor, Bailey Instrument Company, was notified of this problem.

A cause of Inadequate Surveillance Program is assigned to the failure of valve 2SM-5 to fully close. The existing surveillance program for the MSIVs specified full stroke testing of the valves following modification or maintenance. In the past, these tests have been performed with the valves at ambient temperature. This was done to avoid potential inadvertent SIs upon reopening the MSIVs at operating temperature and pressure. This test method did not ensure the valves would meet the timing and stroke requirements at normal operating temperature.

A cause of Deficient Documentation, Incomplete Documentation is also assigned to the failure of valve 2SM-5 to fully close. An investigation into the failure of valve 2SM-5 to fully close revealed that inadequate clearance existed between the yoke rods and the yoke rod guides for the valve actuator. This inadequate clearance resulted in binding, which prevented valve 2SM-5 from fully closing.

A search of the equipment history for valve 2SM-5 revealed that the clearances had been set in accordance with the applicable maintenance procedure, which instructed technicians to restore the clearances to the as found condition following maintenance.

At the request of Engineering personnel the vendor had provided a general manual update. This update included the correct clearances and installation instructions for the yoke rod guides. This information had not been incorporated into the vendor manual because it was still under review. Since the vendor manual is used as the reference document for maintenance procedure development, the clearances and installation instructions were not included in the maintenance procedure.

During the testing of the Unit 2 MSIVs in accordance with procedure PT/2/A/4255/03C, MSIV Functional Test And Closure Verification, on January 5, 1994, it was found that valve 2SM-7 did not fully seat because of an adjustment problem on a different set of guide pins from those which were adjusted at cold conditions.

These guide pins were adjusted on 2SM-7. These same pins were rechecked and adjusted where needed on the other Unit 2 MSIVs. All four Unit 2 MSIVs were then retested and verified to close properly.

The as found condition of valve 2SM-7 during testing on January 5, 1994, would have caused the internal pilot valve to be off its seat, although the main body of the valve would have been on its seat. The small flow path associated with the unseated pilot valve is consistent with the response of the 2A S/G after the SM isolation during the event. .

To correct the problems with the maintenance and testing of MSIVs and the control of vendor information, the following corrective actions were initiated:

a) Unit 1 and 2 MSIV yoke rod guide clearances were measured and reset at normal operating temperature. This was completed by January 6, 1994.

b) A new periodic test procedure, PT/2/A/4255/03C, was written to verify full closure of the MSIVs at full temperature and SM pressure >/= 900 psig.

c) The Unit 2 MSIVs were initially stroke tested per procedure PT/2/A/4255/03C on January 5, 1994.

d) The vendor manual for MSIVs will be revised to include yoke rod guide installation procedure and yoke rod to yoke rod guide clearances (Problem Investigation Process (PIP) 2-M93-1324).

e) The Unit 1 MSIVs will be stroke tested at operating temperature and pressure at the first opportunity.

f) A Nuclear Network bulletin discussing the MSIV failure was issued on December 31, 1993.

In addition to these actions, an evaluation was conducted to identify any needed short term procedure changes associated with safety related equipment, based on pending technical bulletins, vendor manual re-issues, etc. No items were identified which required attention prior to Unit 2 startup (PIP 2-M94-0025).

As a result of the SI and SM isolation following the loss of offsite power, a Project Team was formed, under the leadership of the MNS System Engineering Group. This team will develop planned actions that will reduce the probability of a SI following a loss of offsite power.

A cause of Inappropriate Action, Failure To Follow Procedure is assigned

to the inadvertent failure to initially complete procedure RP/0/A/5700/10. This cause is assigned because the OPS Shift Supervisor did not ensure the required NRC 1 hour notification was completed in accordance with the procedure RP/0/A/5700/10.

Later in the event, on December 28, 1993, at approximately 0100, the Dedicated NRC Communicator in the TSC discovered that a copy of procedure RP/0/A/5700/10 had not been completed. The NRC Dedicated Communicator executed a procedure RP/0/A/5700/10 notification at approximately 0132.

As a result of the failure to complete procedure RP/0/A/5700/10 the following corrective actions were initiated:

a) An immediate training package (Training Package 94-001) was issued by Operations which requires the Shifts to designate an SRO to ensure proper notifications to offsite agencies are performed. In addition, emphasis was placed on the timeliness and accuracy of the information provided to offsite agencies.

b) Procedure RP/0/A/5700/10, NRC Immediate Notification Requirements was revised to include approval by the Shift Supervisor/Emergency Coordinator prior to transmittal of information.

During this event the Technical Specification 3.4.9.1 cooldown rate of 100 degrees F per hour was exceeded. The cause of this excessive cooldown rate was the failure of valve 2SM-5 to fully close, resulting in excessive heat removal from the NC system via the 2B S/G. An Operability Evaluation was conducted and documented in PIP 2-M93-1341. This evaluation concluded that the integrity of the Unit 2 NC system piping, Reactor Vessel, and S/Gs were not challenged from a fatigue point of view and are operable.

As a result of the failure of 2SM-5 to fully close, S/G 2B was emptied. An Operability Evaluation for S/G 2B was conducted and documented in PIP 2-M93-1319. This evaluation concluded that the transient did not adversely effect the tube integrity of S/G 2B. The evaluation also determined that no tube inspections were necessary as a result of the transient.

During the event the PRT Rupture Disks relieved to prevent overpressurization of the PRT. An Operability Evaluation for the PRT was conducted and documented in PIP 2-M93-1323. This evaluation concluded the PRT Rupture Disks functioned as designed and that the PRT remained

operable. Prior to restart both PRT Rupture Disks were replaced. Visual inspections of the PRT nozzle welds, steam deflector supports, mechanical snubbers and the first normally closed diaphragm valves off the PRT were conducted. No problems were identified.

Following relief of the PRT Rupture Disks, steam and water were released into Unit 2 Lower Containment. An Operability Evaluation to assess the environmental impact of the release was conducted and documented in PIP 2-M93-1321. In conjunction with this evaluation various equipment was inspected and no problems were identified due to moisture intrusion. The results of the evaluation and the inspections indicated no problems existed as a result of the event.

An additional result of the relief of the PRT Rupture Disks was the opening of several Lower Ice Condenser Doors. An Operability Evaluation was conducted to ensure the Ice Condenser was operable following the PRT Rupture Disk event. This Operability Evaluation was documented in PIP 2-M93-1327. The evaluation concluded the Ice Condenser was operable based upon the completion of all applicable Technical Specification Surveillance Requirements. This included the weighing of ice baskets under work order 93093240.

During the event OPS C/R personnel requested IAE personnel to close valves 2SM-83, 89, 95, and 101. Actions taken by IAE personnel to air line jumper these valves closed actually resulted in the opening of valves. This problem was documented and thoroughly investigated in PIP 2-M93-1338.

A search of the Operating Experience Program (OEP) data base for reportable events occurring during the 24 months prior to this event was conducted. The search revealed no events attributed to Deficient Documentation, or an Inadequate surveillance Program.

The search revealed one event attributed to a Possible Design, Manufacturing, Construction/Installation Deficiency, which was documented in LER 370/92-04. LER 370/92-04 specifically assigned a cause of Possible Installation Deficiency, while this event is assigned a cause of Possible Design Deficiency, due to an unanticipated environmental interaction. The root causes of the two events are different; therefore, the two events are not considered to be similar.

The search revealed one event attributed to a Vendor Fabrication Deficiency, which was documented in LER 369/93-01. While the two events share the same root cause, neither the equipment nor the vendor are the

same.

The search revealed one event attributed to Inappropriate Action, Failure To Follow Procedure, which was documented in LER 369/92-07. While the two events involved the same group, the specific root causes are different. The event involved a failure to properly follow the correct procedure due to an interpretation of a procedure step. This event involved a failure to follow a procedure when one existed. The root causes are not the same; therefore, the two events are not considered to be similar.

This event is not considered to be recurring.

This event is Nuclear Plant Reliability Data System (NPRDS) reportable.

There were no radiation exposures or uncontrolled releases of radioactive material as a result of this event.

CORRECTIVE ACTIONS:

Immediate: 1) Operations C/R personnel responded to the event in accordance with Unit 2 Emergency procedures.

2) Offsite power was restored to unit 2 through the 2A bus line on December 27, 1993, at 2342.

3) Unit 2 was cooled down to Mode 5, Cold shutdown for repairs.

Subsequent: 1) Site Management initiated a Recovery Team to manage recovery plans and implement corrective actions associated with the Unit 2 Loss Of Offsite Power.

2) Site Management activated a Significant Event Investigation Team to investigate the event.

3) Mechanical Maintenance (MM) and Engineering (ENG) personnel adjusted the yoke guide rods on valve 2SM-5 to allow the valve to fully close.

4) Mechanical Maintenance personnel measured yoke rod guide clearances for Unit 1 and 2 MSIVs at full operating temperature in accordance with procedure MP/0/A/7200/11, MSIV And Valve Actuator Corrective

Maintenance.

5) Procedure PT/2/A/4255/03C was written to verify full closure of each MSIV at full temperature and steam line pressure >/= 900 psig.

6) Unit 2 MSIVs were stroke tested in accordance with procedure PT/2/A/4255/03C on January 5, 1994.

7) In accordance with Minor Modification (MM) 5400, Power Delivery Department (PDD) personnel replaced the failed insulator and the other underhung insulators on 2B bus line and repaired PCB disconnect switch 62R.

8) In accordance with MM 5401, PDD personnel replaced underhung insulators on 2A bus line.

9) A visual inspection of Unit 1 bus lines was performed by PDD personnel to verify that insulators installed in the cantilevered position had been previously replaced with Lapp Catalog number J-51688 insulators. There are no underhung insulators in the Unit 1 (230KV) switchyard.

10) PCBs 61 and 62 were inspected and cycled by PDD personnel on December 30, 1993.

11) Instrument and Electrical personnel replaced the failed Digital Input Slave Module DSI01 and the T/G runback circuit was functionally verified under work order 93092661. All other similar modules on Unit 2 were examined to ensure correct jumper configuration. Unit 1 modules were also verified to have the correct jumper configuration.

12) Engineering personnel contacted the DEH system vendor, Bailey Instrument Company, and notified them of the problems with mispositioned jumpers.

13) An immediate training package (Training Package 94-001) was issued by Operations personnel which requires the OPS Shifts to designate an SRO to ensure proper notifications to offsite agencies are

performed. In addition, emphasis was placed on the timeliness and accuracy of the information provided to offsite agencies.

14) Emergency Planning personnel revised procedure RP/0/A/5700/10, NRC Immediate Notification Requirements, to include approval by the Shift Supervisor/Emergency coordinator prior to transmittal of information.

15) Instrument and Electrical personnel were briefed on this event and the importance of attention to detail, along with the use of VTO drawings. Documentation of the briefing to IAE Supervision by the IAE Manager will be maintained in the IAE support area.

16) Engineering personnel red marked C/R and Shift Office Vital To Operation (VTO) drawings (flow diagrams and electrical one-lines) to reflect all changes resulting from each NSM. This included all extraneous information such as piping classification, cable number, etc. These drawings will be used for troubleshooting and communicating complete information among groups.

17) Engineering personnel performed an assessment of the current state of updates to safety related documents and procedures due to vendor information changes (PIP 1-M94-0025). No items were identified which needed to be considered prior to Unit 2 startup.

19) Testing of the Unit 1 runback circuitry was added to the trip list .

20) A Nuclear Network bulletin discussing the insulator failure was issued on December 31, 1993.

21) A Nuclear Network bulletin discussing the MSIV failure was issued on December 31, 1993.

22) Engineering personnel revised the vendor manual for MSIVs to include yoke rod guide installation procedure and yoke rod to yoke rod guide clearances.

Planned: 1) Engineering personnel will setup PMs to ensure all DEH runback circuit field inputs are functionally tested each refueling outage.

2) The Unit 1 MSIVs will be stroke tested at system operating temperature and pressure as soon as practical.

3) As a result of the SI and SM isolation following the loss of offsite power, a Project Team was formed, under the leadership of the MNS System Engineering Group. This team will develop planned actions that will reduce the probability of a SI following a lose of offsite power.

SAFETY ANALYSIS:

The event which occurred, a loss of offsite power to one unit, coincident with a failed Main Steam Isolation Valve, is bounded by events described in chapter 15 of the Final Safety Analysis Report (FSAR). Specifically, it is bounded by the Complete Loss of Reactor Coolant Flow and the Steam Line Break events.

Following the loss of the 2B bus line, the 6.9kV switchgear, which is normally supplied from this source, successfully completed an automatic transfer to the 2A bus line. However, the failure of the Unit 2 T/G to runback caused the 2A bus line to subsequently trip due to an overcurrent condition. A Reactor Trip occurred, as designed, prior to reaching any of the established Reactor core safety limits. The main generator tripped, causing a complete loss of Unit 2 auxiliary power.

The flywheel of the NC pumps performed its design function and extended the coast down time of these pumps and thus established the proper conditions to initiate natural circulation flow through the Reactor core. The natural circulation flow, which is maintained due to density changes in the NC system, allowed heat to be removed from the Reactor core and transferred to the S/Gs as designed. The operation of the SM Line PORVS allowed the excess heat to be dissipated to the environment, as designed, from the secondary side of the S/Gs. With the automatic initiation of Auxiliary Feedwater, which initially supplied several hundred gallons per minute of feedwater flow to each S/G, Unit 2 was in a condition to maintain heat removal from the NC system indefinitely.

During this event, electrical power was supplied to the safety related

equipment by emergency D/Gs. These D/Gs started automatically due to the loss of offsite power, and supplied power to the 4.16kV busses until offsite power was restored. The D/Gs operated as designed through out this event and electrical power for the safety related equipment was not a concern during the event.

This loss of power event was complicated by an excessive cooldown which has been attributed to the large amount of Auxiliary Feedwater flow and to various steam leakage paths. This cooldown led to the initiation of Safety Injection due to low Pressurizer pressure. The Safety Injection signal initiates system realignments and actuation to provide a source of make up water to the NC system. The Safety Injection systems functioned as designed in this event. The excessive cooldown also resulted in a signal to isolate the SM lines. This isolation was not completely successful due to the failure of 2SM-5 to completely close. With this valve not fully closed the cooldown continued until the 2B S/G was emptied and CA system flow was throttled. The rate at which the NC system was cooling down was slowed by actions taken from the C/R to limit the effect of the transient.

The Technical Support Center, which was activated as a precaution during the event, took an active role to ensure that once the 2B S/G was empty, no water was reintroduced. This measure prevented the creation of thermal stress in the 2B S/G, which could have led to damage of the S/G tubes. This event did not result in any leakage of primary coolant (NC system) through 2B S/G tubes.

The overall response of the plant, from a safety point of view, was satisfactory through out the event. There were equipment failures which initiated the transient and failures which contributed to the severity of the event. However, at no time during the event was there a challenge to Reactor Safety and the safety system response was sufficient to prevent degradation of the event to a more serious level. During the event, plant parameters did not exceed any safety limit as defined by Technical Specifications.

All radiological releases associated with the release of steam during the event were well within acceptable levels and all Nc system releases were maintained inside the primary containment structure. There were no radiological consequences associated with the event.

This event was not significant with regard to the health and safety of the public.

ADDITIONAL INFORMATION:

SEQUENCE OF EVENTS

Key to Data Sources:

ER Events Recorder, Time to Milliseconds
AS Operator Aid Computer (OAC) Alarm Summary, Time to the second
TM OAC Transient Monitor Data Plots, Time to seconds
CRI Control Room Indication
SRO Senior Reactor Operator (SRO) Logbook Entry Times
BE Best Estimate based on Engineering/Operational Judgment
APD All Points Data Base - OAC Data Archived Every 5 minutes

12/27/1993

22:06 Received loss of BL2B, observed T/G not running back (SRO)
22:06:31.588 Generator Breaker 2B open (ER)
22:06:31.757 PCB 61 tripped (B Buss) (ER)
22:06:32.025 PCB 62 tripped (B Buss) (ER)
22:07:00 NIS N41 Power - 100.079% (TM)
22:07:00.161 PCB 58 tripped (A Buss) (ER)
22:07:00.179 Unit 2 OPC Operation (ER)
22:07:00.292 PCB 59 tripped (A Buss) (ER)
22:07:00.343 Unit in Full Load Rejection (ER)
22:07:01 All Turb. Governor Valves, Intercept Valves, Closed.
SB-9 & 21 (Steam Dumps) started to open (AS)
22:07:07 Pzr PORVs NC-34, NC-36, NC-32 open (AS)
22:07:07.992 NIS Hi Flux Rate Power Range Rx-Trip (ER/BE)
22:07:08.079 Reactor Trip Breaker A Open (ER)
22:07:08.095 Reactor Trip Breaker B Open (ER)
22:07:08.221 Turbine Trip (ER)
22:07:08.325 Generator Breaker 2A Open (ER/BE)
22:07:08.398 2ETA, 2ETB Undervoltage alarms (ER)
- .505

22:07:08.511 Train A Blackout logic initiated (ER)
22:07:08.515 Train B Blackout logic initiated (ER)
22:07:08.547 Starting Diesel Generators 2A, 2B (ER)
22:07:09 Pzr PORVs NC-34, NC-36, NC-32 closed (AS)
22:07:13.125 Manual Reactor Trip train A (ER)
22:07:13.149 Manual Reactor Trip train B (ER)
22:07:16.813 2A Blackout logic actuated (ER)

22:07:16.887 2ETA Load Shed (ER)
22:07:16.906 D/G 2B Running (ER)
22:07:16.909 2B Blackout Logic Actuated (ER)
22:07:16.992 2ETB Load Shed (ER)
22:07:17.279 D/G 2A Running (ER)
22:07:18.018 D/G 2A Breaker Closed (ER)
22:07:18.072 D/G 2B Breaker Closed (ER)
22:07:25 2A & 2B FWPT Tripped (AS)
22:07:29 TD CA flow starts and reaches approximately 210 gpm per S/G
22:07:44 A and B CA Pumps Start (AS)
22:07:50 CA Pumps A&B On (AS/TM)
22:07:50 SA-49 Opened (AS)
22:08:37 SA-48 Opened (AS)
22:10:04 3 PORVs (SV-1, 13, 19) closed (AS)
2 Code Safety Relief valves (SV-2, 14)
closed (AS)
22:14 Received SI on "LO PZR PRESS" (SRO)
22:14:04.056 Pressurizer low pressure safety injection (ER)
22:14:05.759 Steamline B lo pressure safety injection (ER)
22:14:11 ND pumps A and B on (AS)
22:14:11 NI pumps A and B on (AS)
22:14:11 SM-1, SM-3 and SM-7 Closed (AS)
22:14:14 NI-9 & NI-10 (BIT dischg. Isol.) (AS)
22:14:35.912 Steamline C lo pressure safety injection (ER)
22:15 Ice Condenser temperature increase (CRI/BE)
22:15:07.819 Steamline A lo pressure safety injection (ER)
22:15:34.075 Steamline D lo pressure safety injection (ER)
22:22 Declared NOUE "Notification of Unusual Event" (SRO)
22:23:17 SA-48 Closed (AS)
22:23:20 CA flow stopped to all four S/G's (TM)

22:24:29 SM-15 Indicated Closing (AS)
22:26:33 CA flow started for S/G B (pegged high off (TM) scale)
22:28 - 22:49 Pzr PORVs cycled about once per min. (AS)/(TM)
22:29:57 CA flow started for S/G A (TM)
22:32:00 CA flow stopped for S/G A (TM)
22:36:29 CA flow stopped for S/G B (TM)
22:36:45 CA flow started for S/G A (TM)
22:40:21 SM-15 Closed (AS)
22:41:09 ND pump B off (AS)
22:41:10 ND pump A off (AS)
22:41:14 NI pumps A and B off (AS)
22:43 Max. lower containment ambient (AS)
22:45:49.939 S/G B lo level reactor trip (ER)

22:49:52.850 Pzr Safety Injection Reactor Trip signal (ER)
22:51:44.186 Pzr Safety Injection Reactor Trip signal (ER)
22:56:36.247 Unit 2 Condenser vacuum low trip (ER)
23:01:35 PRT Pressure -50.3 psig (AS)
23:06:05.573 Pzr Safety Injection Reactor Trip signal (ER)
23:23:19 PRT Pressure -52.3 psig (AS)
23:26:44 PORV NC-36 Open (AS)
23:26:49 PRT Pressure - 7.6 psig, (AS/BE)
23:27:23 PORV NC-36 Closed (AS)
23:30 (Approx.) Several Ice Condenser Temperatures Increasing (CRI/BE)
23:42 Re-energized BL2A (SRO)
23:42:03 Offsite power restored (ER)

12/28/93

00:18 2ETB Re-energized from Offsite (SRO)
00:32 2ETA Re-energized from Offsite (SRO)
01:37:18 Reactor Coolant Pump A on (AS)
07:37 SM pressure equalized in all four (TSC)
12:55 Secured from Notification of Unusual Event (SRO)

Duke Power Company T. C. McMEEKIN
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DUKE POWER

January 26, 1994

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station Unit 2
Docket No. 50-370
Licensee Event Report 370/93-08
Problem Investigation Process No.: 2-M93-1316

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 370/93-08 concerning a Unit 2 Reactor Trip caused by loss of offsite power. This report is being submitted in accordance with 10 CFR

50.73 (a) (2) (i) and 50.73 (a) (2) (iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

T.C. McMeekin

TLP/bcb

Attachment

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